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Innovation in Earth-Abundant Hole Transport Materials for High Efficiency Cadmium Telluride Solar Cells EBIN BASTOLA, KAMALA KHANALSUBEDI, SUNETH WATTHAGE, ZHAONING SONG, NIRAJ SHRESTHA, ADAM PHILLIPS, KHAGENDRA BHANDARI, MICHAEL HEBEN, RANDY ELLINGSON, Center for Photovoltaics Innovation and Commercialization (PVIC), Department of Physics and Astronomy, University of Toledo — Colloidal nanocrystal-based thin films have been demonstrated as effective light-absorbing layers for solar energy harvesting applications. Such nanocrystalline thin films can also be applied as efficient hole transport materials in solar cells including cadmium telluride (CdTe) for the efficient transfer and transport of photo-generated charge carriers. Here, we report the properties of specific earth abundant solution-processing materials acting as the efficient hole transport layers (HTLs) in CdTe solar cells, and we summarize the key properties for effective HTL's in CdTe and more generally for an arbitrary photovoltaic (PV) absorber material. Colloidal nanocrystals are promising materials for opto-electronic applications, and may in many cases be synthesized by using earth-abundant materials via a thermal-injection route. Examples of materials we will discuss include iron pyrite (FeS_2), $Co_xFe_{1-x}S_2$, $Ni_xFe_{1-x}S_2$, $(CuS)_x(ZnS)_{1-x}$ and perovskites. The HTLs are fabricated on the top of the CdTe devices using these colloidal NCs. Our results using solution-processed NC-based thin films as HTLs for CdTe PV devices show improvements in photoconversion efficiency reaching approximately 10 %.

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